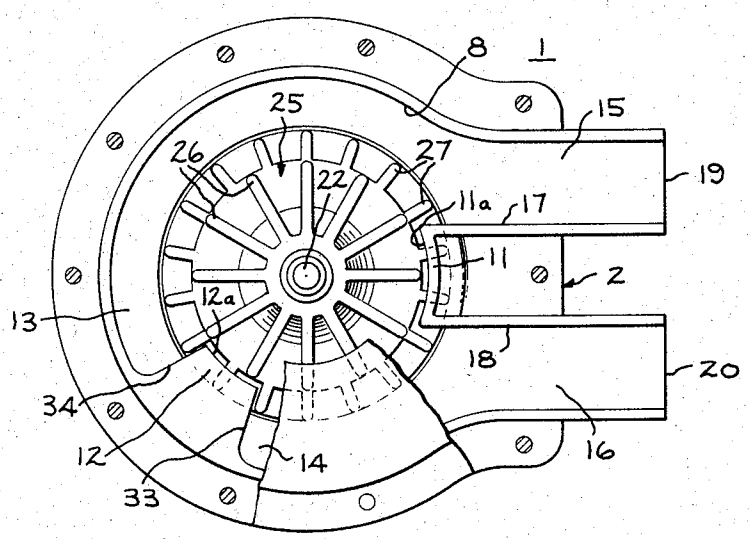
Dec. 26, 1967 J. BOCHAN 3,359,907

CENTRA-TURBINE PUMP

Filed June 24, 1965

FIG. 1



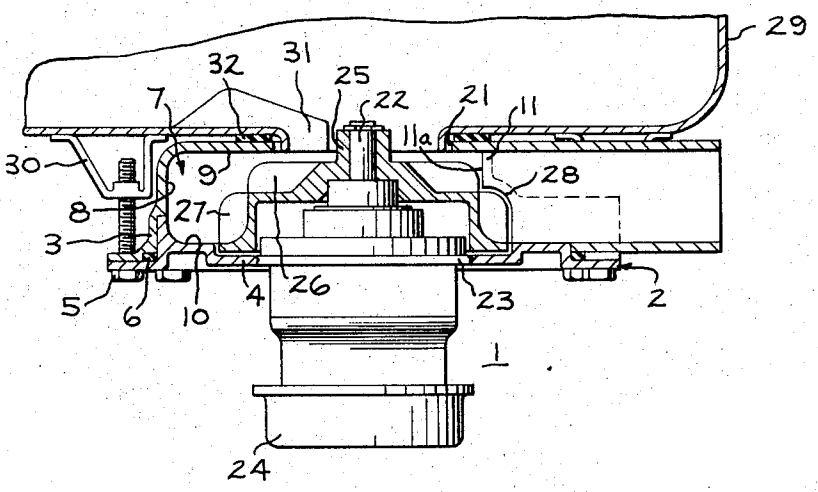


FIG. 2

INVENTOR.
JOHN BOCHAN
BY Radford M. Reams
HIS ATTORNEY

United States Patent Office 3,359,907 Patented Dec. 26, 1967

3,359,907

CENTRA-TURBINE PUMP

John Bochan, Louisville, Ky., assignor to General Electric Company, a corporation of New York

Filed June 24, 1965, Ser. No. 466,776
6 Claims. (Cl. 103—3)

ABSTRACT OF THE DISCLOSURE

A fluid pump having a pair of adjacent pump chamber sections with an outlet for each section and a single inlet. An impeller is mounted for reversible rotation within the housing. The impeller includes a centrifugal portion in axial alignment with the inlet and a turbine portion axially inward and radially outward of the centrifugal portion.

Background of the invention

It is often desired selectively to pump fluid from a single source to either of two destinations. A single pump of the centrifugal or combination axial and centrifugal types can perform this function. These pumps, however, are not suitable for all applications because they cannot efficiently pump fluids which have entrained therein foreign matter of a solid nature. A turbine pump, since it has a higher pressure head for the equivalent pump size as compared to centrifugal and axial pumps, may be used to pump efficiently fluids which have entrained therein foreign matter of solid nature. Prior art reversible turbine pumps of a single deck variety have a substantial disadvantage. The pumping action of such pumps tends to pull air in through the unused outlet and mix it with the liquid being pumped. In all applications this reduces the pump efficiency and results in an undesirable lowering of the outlet head pressure. Additionally, in uses such as the pump for an automatic washing machine, the air entrainment caused an additional, even more serious, problem. In such applications, the pump in one direction is commonly utilized to recirculate liquid within the washing machine. The entrainment of air in this recirculated liquid causes foaming of the detergent in the liquid and results in an excessive build-up of suds within the machine. This reduces the washing efficiency of the machine and may, in extreme cases, cause the machine to malfunction. Therefore, the more common prior art approach has been to utilize a double deck turbine pump. A double deck turbine pump is really two pumps placed side by side and driven by a common, reversible power source. Each pump is designed to be effective in only one direction of rotation. Such an approach results in a pump structure which is bulky in form and almost twice as expensive as a single deck pump.

It is an object of this invention to provide an improved pump to transfer fluid from a single source selectively to either of two destinations.

It is a further object of this invention to provide a single deck pump which is effective to transfer fluid from a single source to either of two destinations.

It is a still further object of this invention to provide an improved, single deck pump of the centra-turbine type which is effective to transfer liquid from a single source selectively to either of two destinations without entraining air in the fluid being pumped.

Brief description of the drawing

For a better understanding of this invention reference may be had to the following description and the accompanying drawings in which:

FIGURE 1 is a plan view of a pump incorporating one embodiment of my invention, the view being partly broken away for purposes of illustration.

FIGURE 2 is a side elevational view of the pump of FIGURE 1, showing the pump attached to a source of liquid, the view being partly broken away and partly in section for purposes of illustration.

Description of the preferred embodiment

Referring now to the drawing, there is shown therein a centra-turbine pump **1**. The pump **1** includes a housing **2** formed by joining an upper housing member **3** and a lower housing member **4**. In the embodiment shown the housing members **3** and **4** are joined by a number of bolts, such as **5**, which are threaded in appropriate openings in the two housing members to draw them tightly together. An appropriate seal **6** may be provided to insure that liquid does not leak out of the housing.

The housing forms a pump chamber **7** having an annular side or peripheral wall **8** and a pair of spaced end walls **9** and **10**, in this instance the end wall **9** being the top and the end wall **10** being the bottam.

The peripheral wall **8** is formed with a pair of indentations or dams **11** and **12** which extend generally radially inwardly into the pump chamber so as to divide the chamber into a pair of adjacent chamber sections **13** and **14**. The peripheral wall **8** includes a pair of outlets or openings **15** and **16** formed adjacent the opposite sides of dam **11**. Although, in the preferred form of my pump the side walls **17** and **18** of the dam **11** form part of the wall defining the outlets **15** and **16** respectively, the outlets may be slightly removed from the sides of the dam if desired. The portions of the housing forming the outlets **15** and **16** extend outwardly from the main body of the housing to form nozzles **19** and **20** to which suitable conduits may be attached for conducting liquid away from the pump.

End wall **9** is formed with an opening **21** therethrough to provide an inlet to the pump chamber **7**. A shaft **22** extends within the pump chamber **7** generally in axial alignment with opening or inlet **21** through an opening in the end wall **10** and is provided with a water tight seal by means of a gasket **23**. The shaft **22** is attached to a pulley **24** so that the shaft may be rotated selectively in either direction from suitable power source (not shown). A centra-turbine impeller **25** is securely mounted on shaft **22** for rotation therewith and includes a first portion having a number of centrifugal type vanes **26** which are in alignment with inlet **21**. The impeller also includes a second portion axially inwardly and radially outwardly of the first portion having a plurality of turbine vanes **27**.

The inner surfaces **11***a* and **12***a* of the dams **11** and **12** respectively are offset outwardly, as indicated at **28**, so that both the centrifugal vanes **26** and the turbine vanes **27** pass closely adjacent the inner surface of each of the dams. The centrifugal vanes **26** and the turbine vanes **27** are both formed and spaced so that their outer ends span a distance which is less than the width of the corresponding portions of the inner surfaces **11***a* and **12***a* of dams **11** and **12**.

During operation the pump is supplied liquid through inlet **21** so that the liquid impinges axially upon the impeller **25**. For this purpose the pump **1** has been shown mounted to the underside of a liquid container **29** by having at least some of the bolts **5** received in brackets **30** formed on the underside of the container. The container is shown with an outlet **31** in communication with inlet **21**. A gasket **32** is securely received between upper housing member **3** and container **29** radially outwardly of inlet **21** to prevent liquid leakage therebetween.

Referring now particularly to FIGURE 1, and assuming that impeller **25** is rotated in a clockwise direction and liquid is supplied from container **25**, the operation of the pump is as follows. The liquid enters the pump chamber

7 and impinges axially upon the centrifugal section of the impeller. The liquid is forced generally radially outwardly by centrifugal vanes 26 to fill both of the chamber sections 13 and 14. As the turbine vanes 27 pass through chamber section 13 they cause the liquid therein to flow outwardly through outlet 15. The passage of the turbine vanes through chamber section 14 causes liquid to build up against the side wall 33 of dam 12. Although the clearance between the inner surface of dam 12 and the impeller allows a small amount of this liquid to pass by the dam into chamber section 13 the dam restrains most of the liquid and causes a body of liquid to build up between chamber section 14. This effectively closes outlet 16 and prevents the impeller from drawing air inwardly through outlet 16 and entraining it in the liquid.

When the impeller 25 is rotated in the opposite, or counterclockwise direction, as seen in FIGURE 1, the passage of the turbine vanes 27 through pump chamber section 14 causes liquid to be pumped outwardly through outlet 16 while the passage of turbine vanes 27 through chamber section 13 causes a head of liquid to build up against side wall 34 of dam 12. This prevents air from being drawn in through outlet 15 and entrained in the liquid being pumped.

Thus, depending upon the direction of rotation of the impeller 25, pump 1 functions to transfer liquid from a single source selectively to either of two destinations and prevents air from being entrained in the liquid in either direction of rotation. It will be obvious that the physical positioning of dam 12 within pump chamber 7 may be varied in order to vary the relationship between the output pressures at outlets 15 and 16.

It will be understood that opening 21 may be moved with respect to impeller 25 and chamber sections 13 and 14. Also, the shape of the opening may be varied so that more of the opening communicates with one chamber section than the other. Such changes modify the pumping characteristics of the pump and may be desirable in particular instances. I have found that the most uniformly desirable configuration is to have a centered symmetric opening in axial alignment with impeller. However, all that is required is that the opening be substantially in axial alignment with the impeller so as to cause both pump chamber sections to be filled.

While I have shown and described a particular embodiment of my invention, I do not desire the invention to be limited to the particular construction disclosed, and I intend by the appended claims to cover all modifications within the true spirit and scope of the invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. A reversible fluid pump comprising:
(a) a housing forming a pump chamber having a peripheral wall and a pair of spaced end walls;
(b) said peripheral wall including a pair of spaced, inwardly extending dams dividing said chamber into a pair of adjacent chamber sections;
(c) said peripheral wall defining an outlet adjacent each side of one of said dams;
(d) one of said end walls defining an inlet;
(e) an impeller mounted for reversible rotation within said chamber;
(f) said impeller including a centrifugal portion substantially in axial alignment with said inlet to insure filling of both chamber sections;
(g) and said impeller also including a turbine portion to force fluid from said pump through a predetermined one of said outlets depending upon the direction of rotation of said impeller.

2. A reversible fluid pump comprising:
(a) a housing forming a pump chamber having a peripheral wall and a pair of spaced end walls;
(b) said peripheral wall including a pair of spaced, inwardly extending dams dividing said chamber into a pair of adjacent chamber sections;

(c) said peripheral wall defining an outlet adjacent each side of one of said dams;
(d) one of said end walls defining an inlet;
(e) an impeller mounted for reversible rotation within said housing;
(f) said impeller including a plurality of centrifugal vanes substantially in axial alignment with said inlet to insure filling of both chamber sections;
(g) and said impeller also including a plurality of turbine vanes axially inward and radially outward of said centrifugal vanes to force fluid from said pump through a predetermined one of said outlets depending upon the direction of rotation of said impeller.

3. A reversible fluid pump comprising:
(a) a housing forming a pump chamber having a peripheral and a pair of spaced end walls;
(b) said peripheral wall including a pair of spaced, inwardly extending dams dividing said chamber into a pair of adjacent chamber sections;
(c) said peripheral wall defining an outlet adjacent each side of one of said dams;
(d) one of said end walls defining an inlet substantially in the center thereof;
(e) an impeller mounted for reversible rotation within said housing;
(f) said impeller including a centrifugal portion substantially in axial alignment with said inlet to insure filling of both chamber sections;
(g) and said impeller also including a turbine portion to force fluid from said pump through a predetermined one of said outlets depending upon the direction of rotation of said impeller.

4. A reversible fluid pump comprising:
(a) a housing forming a pump chamber having a peripheral wall and a pair of spaced end walls;
(b) said peripheral wall including a pair of spaced, inwardly extending dams dividing said chamber into a pair of adjacent chamber sections;
(c) said peripheral wall defining an outlet adjacent each side of one of said dams;
(d) one of said end walls defining an inlet substantially in the center thereof;
(e) an impeller mounted for reversible rotation within said housing;
(f) said impeller including a plurality of centrifugal vanes substantially in axial alignment with said inlet to insure filling of both chamber sections;
(g) and said impeller also including a plurality of turbine vanes axially inward and radially outward of said centrifugal vanes to force fluid from said pump through a predetermined one of said outlets depending upon the direction of rotation of said impeller.

5. A revesible fluid pump comprising:
(a) a housing forming a pump chamber having a peripheral wall and a pair of spaced end walls;
(b) said peripheral wall including a pair of spaced, inwardly extending dams dividing said chamber into a pair of adjacent chamber sections;
(c) said peripheral wall defining an outlet adjacent each side of one of said dams;
(d) one of said end walls defining an inlet substantially in the center thereof;
(e) an impeller mounted for reversible rotation within said housing;
(f) said impeller including a plurality of centrifugal vanes substantially in axial alignment with said inlet to insure filling of both chamber sections;
(g) said impeller also including a plurality of turbine vanes axially inward and radially outward of said centrifugal vanes to force fluid from said pump through a predetermined one of said outlets depending upon the direction of rotation of said impeller;
(h) each of said dams being formed with an offset inner surface so that both said centrifugal vanes

and said turbine vanes pass in close proximity to a portion of said inner surface of each of said dams.

6. A reversible fluid pump comprising:

(a) a housing forming a pump chamber having a peripheral wall and a pair of spaced end walls;

(b) said peripheral wall including a pair of spaced, inwardly extending dams dividing said chamber into a pair of adjacent chamber sections;

(c) said peripheral wall defining an outlet adjacent each side of one of said dams;

(d) one of said end walls defining an inlet substantially in the center thereof;

(e) an impeller mounted for reversible rotation within said housing;

(f) said impeller including a plurality of centrifugal vanes substantially in axial alignment with said inlet to insure filling of both chamber sections;

(g) said impeller also including a plurality of turbine vanes axially inward and radially outward of said centrifugal vanes to force fluid from said pump through a predetermined one of said outlets depending upon the direction of rotation of said impeller;

(h) each of said dams being formed with an offset inner surface so that both said centrifugal vanes and said turbine vanes pass in close proximity to a portion of said inner surface of each of said dams;

(i) the outer ends of adjacent centrifugal vanes and the outer ends of adjacent turbine vanes each spanning a distance less than the width of the corresponding portion of the inner surface of either of said dams.

References Cited

UNITED STATES PATENTS

2,724,338	11/1955	Roth	103—96
2,946,286	7/1960	Sholtes et al.	103—2
3,040,663	6/1962	Cushing	103—2
3,179,307	4/1965	Duncan et al.	103—3

FOREIGN PATENTS

83,531	3/1935	Sweden.
375,994	11/1958	Sweden.

DONLEY J. STOCKING, *Primary Examiner.*

W. L. FREEH, *Assistant Examiner.*